Draft
Wasteload Allocation Procedure

Water Quality Bureau

February 5, 2015

Outline

- Purpose of the Rule Making
- Components of the Rule
  - *E. coli* sample maximum clarification
  - Wasteload Allocation Procedure
- Fiscal Impact Statement (FIS) and Job Impact
- Comments & Questions

Purpose of the Rule Making

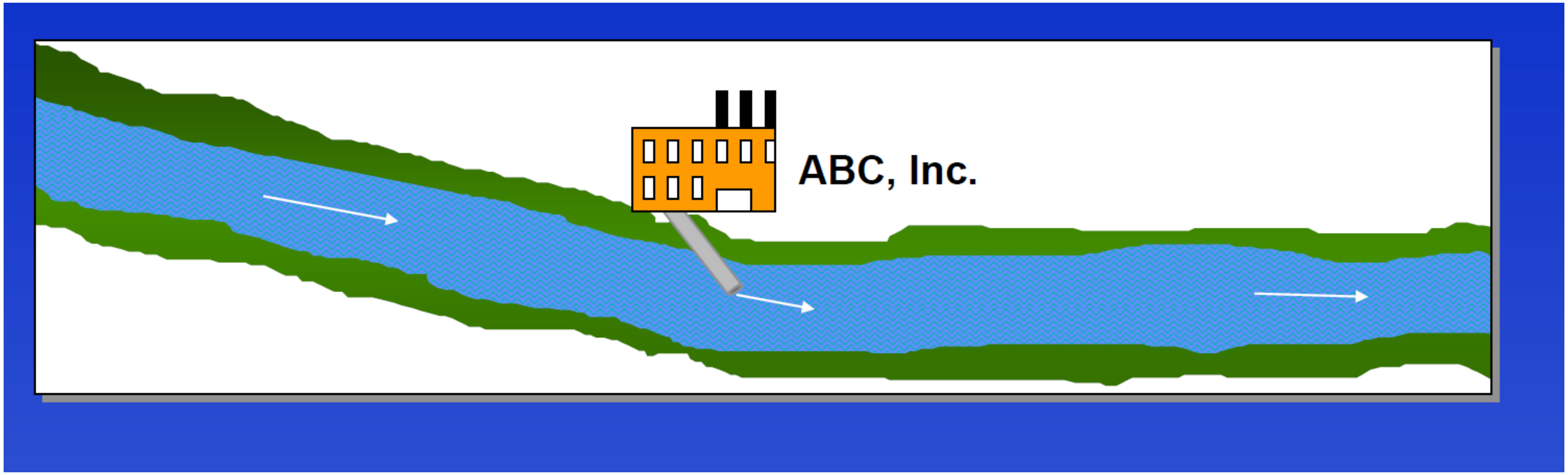
- Two-Fold:
  - *E. coli* sample maximum clarification

    To clarify that a single sample maximum criterion for *E. coli* of 235 organisms/100 ml of water may be used only to make short term decisions about notification of designated beaches
  - Update the Wasteload Allocation Procedure

    to reflect the latest science and monitoring data

Update the Wasteload Allocation Procedure

- What is a Wasteload Allocation (WLA)?



WLA = the maximum allowable pollutant concentration in the effluent from a point source discharger which, after accounting for available dilution, will meet water quality standards in-stream

Update the Wasteload Allocation Procedure

- 4 topics are unchanged
- 11 topics with proposed changes

Topics – No Changes

1. Discharge Flow Determination
2. Chloride and Sulfate
3. Narrative Water Quality Standards
4. Permit Derivation Procedure

Topics – Proposed Changes

1. Design Stream Low Flow Determination
2. Ammonia Nitrogen
3. Toxics (Metals and Other Parameters)
4. Total Residual Chlorine (TRC)
5. Bacteria
6. Thermal Discharges (Temperature WLA)
7. pH
8. Mixing Zone Procedures
9. Site-Specific Data Collection
10. $CBOD_5$ and DO WLAs
11. Flow Variable Limits

Discharge Flow Determination – No Change

- Wastewater treatment plants:
  - Design 30-day ADW and 30-day AWW flows
- Industrial Discharges – No treatment:
  - 30-day maximum flow
  - Daily maximum flow

Design Stream Low Flow Determination – No Change

Numeric Criteria	Stream Low Flow
Aquatic Life (Toxics)	
Acute	1Q10
Chronic	7Q10
Aquatic Life (Ammonia Nitrogen)	
Acute	1Q10
Chronic	30Q10
Human Health and MCL	
Non-carcinogenic	30Q5
Carcinogenic	Harmonic Mean Flow
CBOD5	7Q10

Design Stream Low Flow Determination (Updating Based on USGS Study)

- USGS gaged locations
  - Use the most recent published USGS 2013 Low Flows
- Ungaged locations
  - USGS 2013 Low Flow Study Report
- The use of monthly critical low flows (only when applicable)
- Stepwise discharge options
  - Demonstration of enough storage

Ammonia Nitrogen

- Statewide default Values Update
  - Background stream pH and Temperature
    - Table 4.1-1 and 4.1-2 on page 10
  - Background ammonia nitrogen concentration
    - Table 4.1-3 on page 11
  - Effluent pH and temperature for covered lagoon
    - Table 4.2-1 on page 12
- Mixing Zone and Zone of Initial Dilution
  - No change
  - Dilution Ratio based
- Facility can submit site-specific data
  - pH and T
  - Mixing zone study

Ammonia Nitrogen

- **Ammonia nitrogen decay in GU or pipes**
  - QUALIIK modeling when data are available
  - First-order decay equation:

$$N_a = N_{a0} e^{(-Kn*t)}$$

Where:

N_a = ammonia nitrogen concentration (mg/L) at time t

N_{a0} = Initial ammonia nitrogen concentration (mg/L)

K_n = Nitrification rate, 0.3/day

t = time, days

Toxics

- Default Mixing Zone
  - No change
  - 25% 7Q10 and 2.5% 1Q10
  - Facility can submit site specific data

- Default Background Concentration
  - Update using most up to date monitoring data
  - See the following table for the revision

Toxics WLA
(Background concentration change)

Pollutants	Current Background (µg/L)	Proposed Background (µg/L)	Criteria affected
2,4-D	0.0	0.075	HH – F&W(100)
Atrazine	0.0	0.094	MCL (3.0)
Barium	0.0	94	HH – F&W (1000)
Fluoride	0.0	250	MCL (4,000)
Nitrate-N	0.0	5,865	MCL (10,000)
Nitrate + Nitrite N	0.0	5,900	MCL

Total Residual Chlorine (TRC)

- Eliminate default TRC decay of 0.3mg/L in the mixing zone
- Replace with site-specific measurement

Bacteria

- Continuous discharges

40 CFR § 122.45(d) states: "For continuous discharges all permit effluent limitations…shall unless impracticable be stated as:

(1) Maximum daily and average monthly discharge limitations for all dischargers other than publicly owned treatment works; and

(2) Average weekly and average monthly discharge limitations for POTWs."

Bacteria

E. coli Monthly Geomean and Maximum Daily Limits for Continuous Discharges (org/100mL)

Recreational Uses	Monthly Geomean Limit	7-day Geomean Limit (5/week sampling)	7-day Geomean Limit (2/week sampling)	Maximum Daily Limit	Maximum Daily Limit
Class A1 or A3	126	213	356	635	1,073
Class A2	630	1,266	2,511	5,434	5,367

Bacteria

E. coli Monthly Maximum Daily Limits for Intermittent Discharges (org/100mL)

Recreational Uses	Monthly Geomean Limit	7-day Geomean Limit (5/week sampling)	7-day Geomean Limit (2/week sampling)	Maximum Daily Limit	Maximum Daily Limit
Class A1 or A3	~~126~~	~~213~~	~~356~~	635	1,073
Class A2	~~630~~	~~1,266~~	~~2,511~~	5,434	5,367

Bacteria (Decay)

- *E. coli* decay in non-Class A water
  - First-order decay model:

$$C_d = C_e * e^{(kt)}$$

Where:

C_d = Allowable *E. coli* discharge limit, org/100 mL

C_e = WQS for Class A waters

K = *E. coli* decay rate coefficient

t = Time of travel in the modeled reach, days

- **Decay rate coefficient is reduced from 5.28/day to 1.03/day**

Chloride and Sulfate – No Change

- Chloride & Sulfate standards depend on hardness
- Facilities have the option to collect site-specific hardness data
- Site-specific data collection follows the procedure
  - 2 years once per month

Thermal Discharges (Temperature WLA)

- Major changes from the current procedure
- Major change in background temperature
- Provide options for alternative limits

Iowa's Temperature Water Quality Standard

- For all warm water streams
  - Maximum 32° C
  - Temperature rise <3° C
  - Rate of change ≤1° C/hour

- Additionally for Mississippi River
  - Shall not exceed Table value more than 1% of hours in 12-months
  - No more than 2° C above Table value at any time

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
II	4	4	12	18	24	29	29	29	28	23	14	9
III	7	7	14	20	26	29	30	30	29	24	18	11

Key Factors Impacting Temperature Limits

- Background Temperature (proposed change)
- Mixing Zone (no change)
- Stream Flow (no change)
- Discharge Flow (no change)
- Heat loss in discharge pipe or general use segment when applicable (proposed change)

Proposed Background Temperature & Justification

WLA Procedure for T	Default Ambient Background Temperature	
	3°C - Based Average Limits	Daily Maximum Limits
Proposed	Maximum monthly Temperature	90^{th} percentile monthly Temperature
Current	Interior Streams: Maximum Monthly Mississippi River: 99^{th} Percentile for each month	Interior Streams: Maximum Monthly Mississippi River: 99^{th} Percentile for each month

Temperature – Mixing Zone

- No change from the current procedure
- The MZ is 100% of the 7Q10 flow when the dilution ratio of stream flow (or 7Q10) to discharge flow is less than or equal to 2:1;
- The MZ is 50% of the 7Q10 flow when the dilution ratio of stream flow (7Q10) to discharge flow is less than or equal to 5:1 and greater than 2:1;
- The MZ is 25% of the 7Q10 flow when the dilution ratio of stream flow (7Q10) to discharge flow is greater than 5:1

Temperature – Heat Loss Calculations

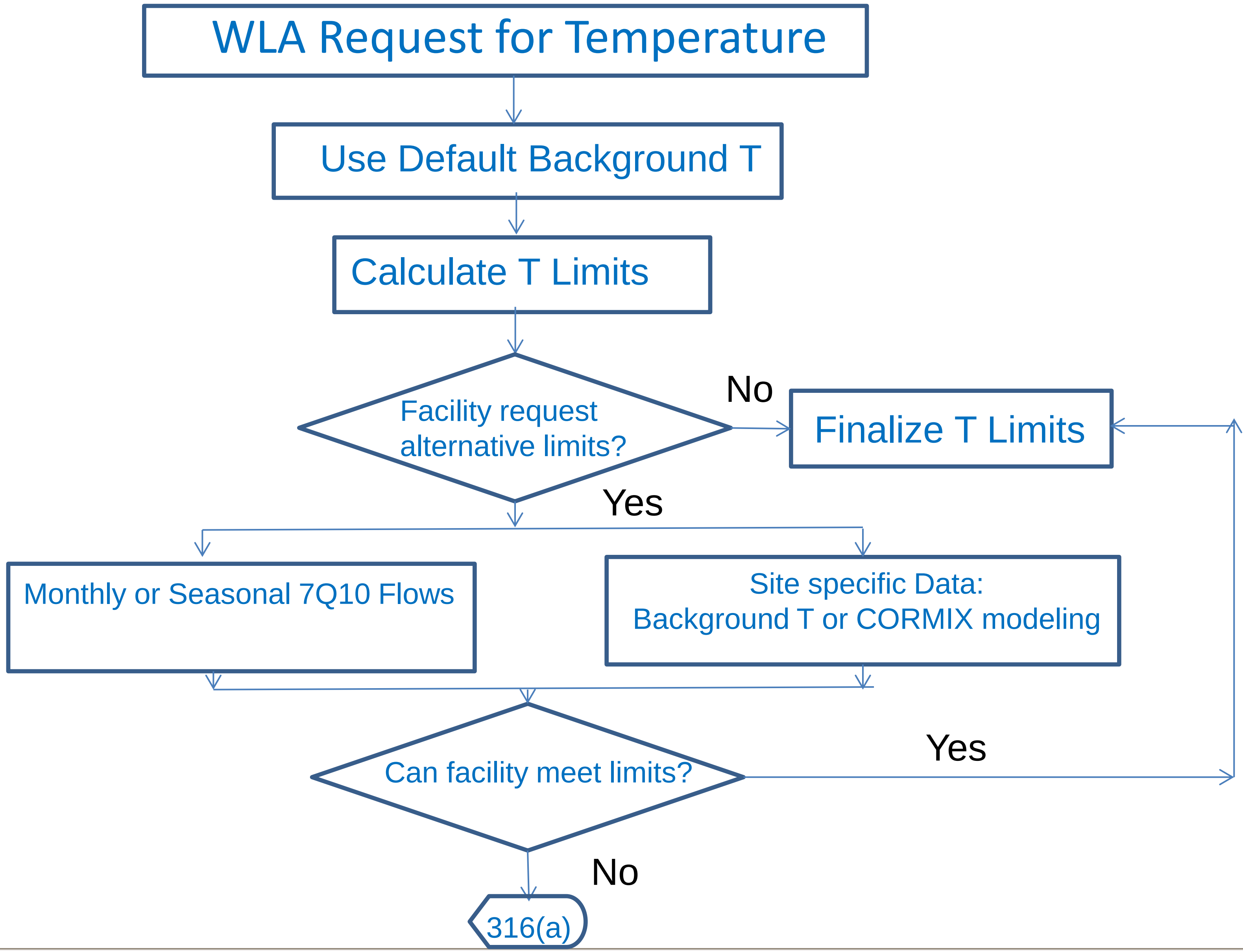
- Current procedure:
  - Temperature drop per 100 feet (average over the pipe length) at different effluent temperature and discharge flows based on default assumptions

- Proposed procedure:
  - Use of updated and more accurate heat transfer models
    - General Use Reach – SSTEMP
    - Discharge pipes/storm sewers/tile lines – spreadsheet model
    - Modeling along the total length of the pipe
    - Default assumptions:
      - Thermal conductivity of water k_w: 0.58 (W/m K)
      - Storm sewer pipe inner diameter: 3 feet
      - Storm sewer wall thickness: 4 inches
      - Storm sewer velocity 0.5 fps

Temperature – Flexibilities for the Proposed Procedure

- 3°C (or 2°C rise) does not apply to effluent created streams
- Continue to use narrative statement in permits for 1 °C/hour change
- Provide flexibilities for alternative options (please see flow chart on next page)

Flexibilities for the Proposed Procedure



pH

- pH applies at the end of the Mixing Zone, not Zone of Initial Dilution
- Default pH WLA using mass balance on hydrogen ion
- When alkalinity and total inorganic carbon data are available for effluent and stream water, use modeling

Narrative Water Quality Standard- No Change

- **IAC 61.3(2)** *General water quality criteria:*

  d. Such waters shall be free from substances attributable to wastewater *discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life.*

- *For general use protection for all chemicals:*

  Translator = ½ LC50

- *The critical low flows in general use waters are zero*

Mixing Zone Procedure

- Default mixing zones for ammonia and toxics are defined in IAC61.2(4)"e" and 61.2(4)"b" – No change
- Facilities can submit site-specific mixing zone data – No change
  - Field dye testing (should guidance document be in rule?)
  - Plume dispersion modeling
  - Installing a diffuser
- Multiple discharges in proximity share the mixing zone - No change

Special Limitations of Mixing Zones - Change

- Where drinking water contaminants are of concern, MZs shall not encroach on drinking water intakes;
- MZs and ZIDs are <u>not</u> allowed for bioaccumulating pollutants including Mercury, Chlordane, PCB and Dieldrin;
- For backwaters and reservoirs:
  - MZ and ZID are 0.1% of the 7Q10 and 0.01% of the 1Q10 for toxics
  - MZ and ZID are 0.1% of the 30Q10 and 0.01% of the 1Q10 for ammonia nitrogen
- For a discharge to a side-channel the corresponding critical low flows in the side-channel should be used to derive wasteload allocations

Site-Specific Data Collection - New

- Water Chemistry Data
  - 2-year once per month – annual statistics
  - 2-year once per week – monthly statistics

- Coefficient of Variation
  - Only apply to toxics
  - Site-specific data to replace default value of 0.6

Water Quality Modeling

- To meet dissolved oxygen (DO) standard of 5 mg/L
- Effluent parameters can affect in-stream DO
  - Effluent ammonia nitrogen
  - Effluent $CBOD_5$
  - Effluent DO
- Water Quality Models
  - Streeter-Phelps model
  - QUALIIK
- Proposed change:
  - $CBOD_5$ decay rate
  - Ammonia nitrogen decay rate (nitrification rate)

Water Quality Modeling

- Proposed Changes:
  - CBOD$_5$ decay rate, depending on:

    (1) Lab CBOD$_5$ decay rate,

    (2) Stream's hydraulic characteristics
  - Ammonia nitrogen decay rate (nitrification rate)
  - Reaeration Rate Models
    - Two USGS models (1999)
      - One model for streams with pools and riffles
      - One model for streams with Channel-Control

Flow Variable Limits

- Replacing flow variable limits with:
  - Stepwise discharge option
  - The use of monthly or seasonable stream flows

Permit Derivation Procedure – No Change

- Translating WLAs to permit limits by considering:
  - Effluent variability
  - Sampling frequency

- No changes

Fiscal Impact Analysis

- How would the proposed rule changes impact point source facilities?
- Including
  - Projected Costs/Cost Savings
  - Job Impacts
  - Other Potential Benefits
- Basic assumptions and evaluations used to approximate potential impacts

Proposed Changes with no Impact

- Updating ambient background pH, temperature, and ammonia
  - More stringent winter, equal/less stringent summer limits
- Updating in-stream background chemical concentrations
  - No discharge or limits for 2,4-D and Atrazine
  - Nitrate limits almost always governed by TMDLs
  - No limits anticipated for Barium or Fluoride
- pH WLA calculations
  - Limits would either be less stringent (WQ based) or the same (technology based)
- Eliminating Flow-Variable Limits
  - 7 Facilities with flow-variable limits
    - 5 can meet non-flow-variable (may need to use monthly flows)
    - 2 more stringent limits are due to new use designations

Fiscal Impacts associated with proposed changes

- Design Stream Low Flow Determination (based on USGS low flow study)
  - 70% with larger critical low flows
  - 13% with critical low flows decreased by at least 0.1 cfs
  - Impact estimated based on meeting ammonia limits
  - Cost savings far outweighs cost
- TRC WLAs (remove default TRC decay of 0.3 mg/L in MZ)
  - Most facilities with TRC already dechlorinate, not impacted
  - Option to collect site specific TRC decay at est. $19-22 dollars for lab analysis
- *E. coli* decay rate coefficient (change from 5.28 to 1.03 @ 20°C)
  - Results in less *E. coli* decay
  - Facilities discharging to long General Use reaches may need disinfection

Fiscal Impacts associated with proposed changes

- Temperature WLAs (different background temperatures, decay calculations)
  - Less stringent limits due to background temperatures used
  - Could be more or less heat loss (where applicable)
- Mixing Zone Limitations (no MZ or ZID for bioaccumulative pollutants)
  - Anticipated to result in additional monitoring requirements
- Site Specific Data Requirements
  - Facilities would save money in monitoring costs
- WQ Modeling (change NBOD and CBOD de-oxygenation rate constants)
  - Additional monitoring may be necessary for a small number of industrial facilities

High Cost and High Cost Savings Scenario

Topic	Projected Fiscal Impact			
	Number of Affected Facilities	Cost	Number of Affected Facilities	Cost Savings
Design Stream Low Flow Determination	1-2[A]	$ 4,473,249	6-7 [A]	$ 24,462,257
Ambient Background pH, Temperature and Ammonia Nitrogen	0	$ -	0	$ -
In-Stream Background Chemical Concentrations	0	$ -	0	$ -
TRC Wasteload Allocation Calculations	464[B]	$ 10,208	0	$ -
E. Coli Decay Rate-(UV Disinfection)	4	$ 1,625,940	0	$ -
Thermal Discharges (Temperature WLA)	6-7 [A]	$ 3,417,931	67-68 [A]	$ 37,597,241
pH Wasteload Allocation Calculations	0	$ -	0	$ -
Special Limitations of Mixing Zones	52	N/A[C]	0	$ -
Site Specific Data Collection - Water Chemistry Data	0	$ -	19	$ 118,560
Water Quality Modeling - CBOD5 and DO WLAs	1	N/A[D]	0	$ -
Flow-Variable Limits	0	$ -	0	$ -
Totals	528-530	$ 9,527,328	92-94	$ 62,178,058

[A]: Estimated via extrapolation

[B]: Very conservative; includes all aerated lagoons and 1-2 cell Controlled Discharge Lagoons

[C]: Annual monitoring cost = $108,160 per year

[D]: Annual monitoring cost = $3,588 per year

Low Cost and Low Cost Savings Scenario

Topic	Projected Fiscal Impact			
	Number of Affected Facilities	Cost	Number of Affected Facilities	Cost Savings
Design Stream Low Flow Determination	0[A]	$ -	2-3[A]	$ 10,388,563
Ambient Background pH, Temperature and Ammonia Nitrogen	0	$ -	0	$ -
In-Stream Background Chemical Concentrations	0	$ -	0	$ -
TRC Wasteload Allocation Calculations	464[B]	$ 8,816	0	$ -
E. Coli Decay Rate-(Chlorination/Dechlorination)	4	$ 1,576,137	0	$ -
Thermal Discharges (Temperature WLA)	6-7[A]	$ 500,483	67-68[A]	$ 5,505,310
pH Wasteload Allocation Calculations	0	$ -	0	$ -
Special Limitations of Mixing Zones	52	N/A[C]	0	$ -
Site Specific Data Collection - Water Chemistry Data	0	$ -	19	$ 118,560
Water Quality Modeling - CBOD5 and DO WLAs	1	N/A[D]	0	$ -
Flow-Variable Limits	0	$ -	0	$ -
Totals	527-528	$ 2,085,436	88-90	$ 16,012,433

[A]: Estimated via extrapolation

[B]: Very conservative; includes all aerated lagoons and 1-2 cell Controlled Discharge Lagoons

[C]: Annual monitoring cost = $108,160 per year

[D]: Annual monitoring cost = $3,588 per year

Job Impacts

- The proposed rule change will have a net cost savings statewide
- Categories affected:
  - Cities
  - Semi-public sectors
  - Industries
- Positive impact on:
  - Private Sector Jobs
  - Employment opportunities

Questions/Comments?